

and 2) of an area 22 on the structure 24 for a particular part number, as well as the programmed path that the head 36 uses to travel in order to cover the area 22 with strips 26 of the damping tape 20. Sensors 112 may be provided which provide signals to the computer 110 relating to the sensed position of the robotic device 38 as well as the status of functions carried out by the head 36.

FIG. 17 illustrates the overall steps of a method for installing damping material on a structure. As shown at 120, the material placement head 36 is moved over the structure 24, and the head 36 is used to place damping material, such as the tape 20 on the structure 24 as the head 36 moves over the structure 24. FIG. 18 illustrates additional details of the method broadly shown in FIG. 17. Beginning at 124, the boundaries 25 of an area 22 on the structure 24 are determined, which will normally be established in digital form. Next, at 126, the number and placement of tape strips 26 required to cover the area 22 within the boundaries 25 may be calculated by the computer 110, which may be based on use of a tape 20 having a specific width "W" (FIG. 1). At 128, the computer 110 (FIG. 16) is programmed to control the movements of the head 36, based on the number and placement of the tape strips 26 calculated at 126. At 130, a spool 54 of tape 20 is loaded onto the head 36.

At 132, tape is dispensed from the spool 54 and the head 36 is moved along a path that has been programmed in the computer 128. As the tape is being dispensed from the spool 54, the lower backing 30b is separated and accumulated on the take up spool 70, as shown at step 134. As the tape is being dispensed and fed to the compaction roller 48, the tape 20 is compacted against the structure 24, as shown at 136. At 138, the tape 20 being placed is cut to length for each tape strip 26.

Embodiments of the disclosure may find use in a variety of potential applications, particularly in the transportation industry, including for example, aerospace, marine and automotive applications. Thus, referring now to FIGS. 18 and 20, embodiments of the disclosure may be used in the context of an aircraft manufacturing and service method 150 as shown in FIG. 19 and an aircraft 152 as shown in FIG. 20. During pre-production, exemplary method 150 may include specification and design 154 of the aircraft 152 and material procurement 156 in which the disclosed method may be specified for use in applying damping materials on components. During production, component and subassembly manufacturing 158 and system integration 160 of the aircraft 152 takes place. The disclosed method and apparatus may be used to place damping materials on components that are later assembled and integrated with other subassemblies. Thereafter, the aircraft 152 may go through certification and delivery 162 in order to be placed in service 164. While in service by a customer, the aircraft 152 is scheduled for routine maintenance and service 166 (which may also include modification, reconfiguration, refurbishment, and so on). Components having damping material applied thereto according to the disclosed embodiments may be used to replace components on the aircraft 152 during the maintenance and service 166.

Each of the processes of method 150 may be performed or carried out by a system integrator, a third party, and/or an operator (e.g., a customer). For the purposes of this description, a system integrator may include without limitation any number of aircraft manufacturers and major-system subcontractors; a third party may include without limitation any number of vendors, subcontractors, and suppliers; and an operator may be an airline, leasing company, military entity, service organization, and so on.

As shown in FIG. 20, the aircraft 152 produced by exemplary method 150 may include an airframe 168 with a plural-

ity of systems 170 and an interior 172. Examples of high-level systems 170 include one or more of a propulsion system 174, an electrical system 176, a hydraulic system 178, and an environmental system 180. Any number of other systems may be included. Although an aerospace example is shown, the principles of the disclosure may be applied to other industries, such as the marine and automotive industries.

Systems and methods embodied herein may be employed during any one or more of the stages of the production and service method 150. For example, components or subassemblies corresponding to production process 150 may be fabricated or manufactured in a manner similar to components or subassemblies produced while the aircraft 152 is in service. Also, one or more apparatus embodiments, method embodiments, or a combination thereof may be utilized during the production stages 158 and 160, for example, by substantially expediting assembly of or reducing the cost of an aircraft 152. Similarly, one or more of apparatus embodiments, method embodiments, or a combination thereof may be utilized while the aircraft 152 is in service, for example and without limitation, to maintenance and service 166.

Although the embodiments of this disclosure have been described with respect to certain exemplary embodiments, it is to be understood that the specific embodiments are for purposes of illustration and not limitation, as other variations will occur to those of skill in the art.

What is claimed:

1. A method of installing damping material on a structure, comprising:

moving a damping material placement head over the structure; and,

using the head to place damping material on the structure, said damping material comprising a removable backing upon a full width of each respective major surface, each of said respective major surfaces comprising a continuous adhesive surface extending across said full width, one of said continuous adhesive surfaces placed by said placement head on said structure following removal of said backings, said removal only prior to said placement.

2. The method of claim 1, further comprising:

using a programmed computer to automatically control the movement of the head over the structure.

3. The method of claim 1, further comprising:

using the head to compact the damping material against the structure as the head moves over the structure.

4. The method of claim 1, wherein using the head to place damping material on the structure includes:

dispensing the material in the form of a tape from a supply of the tape to a compaction roller, compacting the tape onto the structure, and cutting the compacted tape to length as the head moves over the structure.

5. The method of claim 1, wherein using the head to place damping material on the structure includes placing strips of damping tape in a pre-programmed layout on the structure.

6. The method of claim 5, further comprising:

determining the boundaries on the structure where the material is to be installed;

calculating the number and positions of tape strips required to cover the structure within the boundaries;

using the calculated number and positions of the tape strips to program the movements of the head.

7. The method of claim 1, wherein using the head to place damping material on the structure includes: